Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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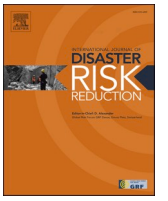

Fear of disasters within the risk communication network of foreign students in Japan amid the COVID-19 pandemic crisis: A cohort design

Minh Tuan Dao [a,b], Seunghoo Lim [b,*]

[a] Bien Hoa National Institute of Forensic Psychiatry, Ministry of Health, Dong Nai Province, Viet Nam
[b] Public Management and Policy Analysis Program, Graduate School of International Relations, International University of Japan, Minamiuonuma, Niigata, 949-7277, Japan

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ABSTRACT

The main objective of this study is to examine the role of risk communication during the COVID-19 crisis, which is often neglected in studies investigating the outbreak of the pandemic. The study is based on survey data from a group of international (non-Japanese) students in Japan and the theoretical foundation of fear appeal theory. The results, which are based on the panel data structure, show that individually, (1) the act of seeking out others to discuss risks in depth in the current pandemic context or (2) the observed adoption of advocated precautionary health behaviours is not necessarily a good indicator of mental management, but (3) the combined effect of (1) and (2) unexpectedly suggests a conciliatory effect on the fear of disasters. Moreover, this evidence-based finding (3) suggests that a reciprocal relationship exists between threat and efficacy in terms of mediating fear under the framework and theory of fear appeals, indirectly challenging the fear control response proposition of the extended parallel process model. Our empirical findings emphasize the role of risk discourse and information sharing combined with preventive health behaviours adopted within a community in the context of global health crises.

1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), or simply COVID-19 as used in World Health Organization (WHO) public health communications, is an unprecedented global pandemic that has an alarmingly high incidence and prevalence rate. This airborne infectious disease may cause a total breakdown of the medical system in a country due to the sudden large number of hospitalization cases, especially in intensive care units [1]. As of 27 December 2020, this global pandemic had infected over 79.2 million people and caused over 1.7 million deaths since it began in late 2019 [2]. Given the increasing studies and available information on COVID-19, governments of different countries have attempted to implement public health policies, notably physical distancing and mask wearing, to varying degrees, from lax to strict, with the aim of curbing the increasing rate of transmission. Governments' tough responses have initiated many philosophically heated debates, and since 2020, growing discussions have centred on the fundamental rights of humans, i.e., individual freedom, during a pandemic [3] and how governments should intervene to promote voluntary citizen behaviours to achieve desired outcomes [4–6]. Public health interventions, especially in a pandemic context, usually involve (i) discourses on risk communication among groups of citizens [7] and (ii) the effectiveness of governmentally

* Corresponding author. International University of Japan, Main Building Rm. #313, 777 Kokusai-cho, Minamiuonuma, Niigata, 949-7277, Japan.
E-mail addresses: tuanminh112093@gmail.com (M.T. Dao), seunghoo.lim@gmail.com (S. Lim).

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advocated health messages based on a comprehensive and emerging model rooted in the theory of fear appeals [8,9]. However, the current discussion on bridging the role of risk communication and health messages seems to be neglected or even ignored and therefore remains unexplored.

This study aimed to examine how a community of international students living in Japan during multiple disasters voluntarily engages in a risk communication network to exchange information about current pandemic events and to explore their behaviours and mental coping mechanisms guided by the fear of disasters over time. In this study setting, the examination of an identifiable risk communication network of a vulnerable group during a health crisis may generate empirical evidence-based findings to contribute to fear appeal theory and/or inform public health administrators and relevant policy-makers in designing public health interventions in the face of global health emergencies.

2. Research background

Natural disasters, risk communication, and other relevant factors among a group of international students in Japan have been insufficiently investigated in the current literature, even though Japan is often known for various types of hazards (e.g., tsunamis, earthquakes, floods) and even human-caused environmental disasters (e.g., the Fukushima nuclear accident). This section summarizes the literature regarding this group and the relevant concepts in disaster and public health studies.

2.1. International students as a vulnerable group in the disaster context

The literature raises the question of including the population of international students in groups regarded as vulnerable. Gómez [10] explored collective behaviours as a reaction to the 2011 Great East Japan Earthquake and presented two rationales to define and place this population in the vulnerable group: (i) some shared similarities with minorities and tourists and (ii) their "foreignness" in terms of language capacity. In the same line of reasoning, a group of international students was selected for this study based on (i) their recent arrival and residence in Japan and (ii) their very limited Japanese language ability as an at-risk group in a disaster context [11]. This vulnerable status indicates that this group requires more attention and in-depth investigation, especially in health emergencies.

2.2. Risk communication and fear appeals

The term "risk communication" may be defined in multiple ways, such as managing risk elements and risk consequences [12] or as an integrative process of exchanging information and opinions among different stakeholders from the individual level to the organizational level [13]. In other words, risk communication refers to risk evaluation inside a community, and its role and implications have gained increasing attention since the influenza pandemic [14] and especially since COVID-19 in 2020 [15–17]. Some studies [7,9,18,19] have emphasized that public health communication that capitalizes on individual emotions, especially fear-based or negative emotions, within a risk communication network can effect changes in citizens' collective behaviours with respect to an intended outcome. Reynolds and Seeger [7] proposed an integrative model incorporating different types of communications: between the government and the general public (e.g., campaigns and designated agencies of formal communication) and among the general public (e.g., the general public's feedback on where they can obtain information and whether rumours or misunderstandings exist inside their community).

However, previous research on fear-based emotion (also known as fear appeals) as a persuasive device and predictor of the outcome of a public health campaign has not taken into consideration (a) the risk deliberation exchange that occurs within a more defined community, thereby disregarding the interaction of risk sharing within a close network; (b) the dynamism of citizens' choices in

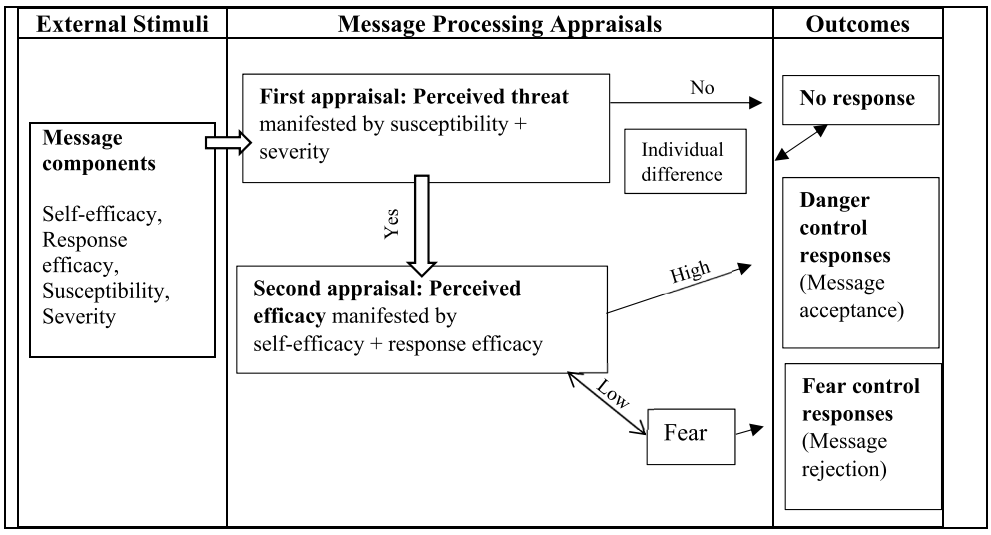

Fig. 1. Extended parallel process model.
Source: Adapted from Witte [27].

adopting the recommended behaviours reflected by the time dimension; and (c) the interaction of (a) and (b) without controlling for mental coping mechanisms (i.e., other emotions) over time. In fact, in this line of research, empirical examinations of fear appeal theory often ignore the role of the time dimension and do not control for other emotional states, i.e., the broad spectrum of positive and negative emotions. Specifically, it is difficult to improve the theoretical internal validity without longitudinal data from several time points.

The following section reviews the latest well-known framework based on fear appeal theory. The author proposes some modifications in the measurements of important constructs for the subsequent analysis and development of a quantitative fear-based model considering the above gaps.

3. Extended parallel process model (EPPM)

3.1. Summary of the EPPM

Throughout human history, the emotion of fear has been exploited as a way for rulers or authorities to adjust human behaviours, but systematic studies of fear appeals have emerged only since the 1950s. Since then, several theories have aimed to explain the processing of fear messages. The latest and most exhaustive model in this field is known as the extended parallel process model (EPPM) by Witte [20] (see also Fig. 1, Table 1). This model mainly incorporates three previous studies on fear appeals, the fear-as-acquired model [21], the parallel process model [22], and protection motivation theory [23,24]. This latest theoretical development has inspired a long list of follow-up empirical research because of its strong explanatory power in the field of public health communication and disaster preparedness research [8,25,26]. However, Popova [27] closely examined the entire body of literature concerning this model and found that the EPPM's propositions and assumptions were not fully explored and supported and that its operationalized constructs were measured differently in different studies. Nonetheless, the EPPM remains a useful guiding tool and theoretical foundation for the exploration of fear appeals in the public health communication field.

Public health campaigns or communications contain messages that aim to change the cognition of citizens regarding the adoption of health-promoting behaviours to curb the transmission or incidence rate of diseases. To evaluate such public health programmes, the EPPM theorizes that four important concepts are embedded in health messages (see also Table 1 for definitions): (1) self-efficacy, (2) response efficacy, (3) susceptibility, and (4) severity (please also refer to subsection 3.2, Measurement of the core constructs, for more details on measurement).

The EPPM posits that two appraisal processes exist (see Fig. 1). First, individuals process information regarding the threat or risk

Table 1
Constructs and operationalized measurements of the EPPM.

Important constructs	Conceptual definition	Operational definition
Fear	Individual negative emotion as a reaction to a relevant threat [28].	Respondents' rate their extent of being "anxious," "scared" or "frightened" regarding the threat [29]. Physiological measurements, such as heart rate [30].
Threat	Individual understanding of the risks of dangers in the surroundings. Reflected by two dimensions: **(i) Severity**: individuals' beliefs about the seriousness of the risks [28]. **(ii) Susceptibility**: individuals' beliefs regarding their probability of experiencing the risk [28].	Both severity and susceptibility are measured via self-report questionnaire scale items. The sum (*) of (i) severity and (ii) susceptibility is the "overall threat score". For example, Lee & You [8] measured perceived severity and susceptibility with two questions: "What do you think is the severity if COVID-19 infects you?" (severity) "What do you think is the probability of a COVID-19 infection?" (susceptibility)
Efficacy	Individual understanding of the recommended measures against the threat. Reflected by two dimensions: **(i) Self-efficacy**: individuals' beliefs about their ability to adopt the measures in the messages [28]. **(ii) Response efficacy**: individuals' beliefs regarding the effectiveness of the recommendations in the messages [28].	Both self-efficacy and response efficacy are measured via self-report questionnaire scale items. The sum (*) of (i) self-efficacy and (ii) response efficacy is the "overall efficacy score". For example, "To what extent do you think each precautionary behaviour is an effective way to reduce the risk of COVID-19 infection?" as a response efficacy measurement [8].
Danger control responses	Cognitive process producing a protection motivation that shows an individual's change in belief, attitude, or intention to adopt the message's recommendations [28]. This mechanism is usually considered a favourable outcome (i.e., individuals follow the health message).	Questionnaire for measuring three dimensions—attitudes, intentions, and behaviours. For example, six preparedness behaviours are defined as danger control responses: reading (i) daily email and (ii) emergency alerts, access to (iii) radio and (iv) first aid kits, watching (v) educational videos on responding to the threat, and viewing (vi) educational posters on responding to the threat [26].
Fear control responses	Emotional process producing a defensive motivation in which a significant threat renders an individual unable to adopt the recommendations through coping mechanisms—e.g., defensive avoidance, denial and reactance [28]. This mechanism, in contrast, indicates that the message failed (i.e., individuals reject the health message with the above coping behaviours).	Different coping mechanisms are measured using self-rating questionnaires. For example, "When I read the message about breast cancer, my first reaction was that I did not want to think about breast cancer" (Likert scale rating from 1 – not at all to 9 – very much) as a measure of message avoidance [31].

Note: (*) In general, the variables are assumed to exhibit an additive relationship.
Source: Adapted from Popova [27].

through the two concepts of susceptibility and severity. The message may be completely ignored if the threat is deemed negligible or nonexistent. Individual differences may contribute to this appraisal stage. Second, once individuals believe that a threat exists, they assess the content of the message to determine whether they can adopt the message (self-efficacy) and whether the message can actually prevent the threat (response efficacy). The original author proposed a calculation of a discriminating value, which is the subtraction of the perceived threat score and the perceived efficacy score (see Table 1 for more information regarding the calculation). If the discriminating value is positive, the individual may engage in danger control responses, i.e., his or her beliefs and behaviours will be consistent with the recommendations in the message; otherwise, when this value is negative, the individual may engage in fear control responses, i.e., his or her beliefs and behaviours exhibit some type of defensive mechanism (avoidance, denial, and reactance) and reject the message [28].

During the model's inception stage, Witte distinguished between threat perception and fear emotion. Thus far, Witte's model has been generally based on fear-based emotion or other negative emotions, as illustrated by the feedback loop between efficacy cognition and fear (see Fig. 1). The benefit of using a negative emotion, such as fear, is primarily due to the easy administration of the survey, and past studies have reported high validity [27]. The fear emotion is usually linked to questions involving a self-rating of being anxious, scared, or frightened about the threat message [29] or measurable physiological changes, such as heart rate [30] (see Table 1). Other negative emotions, such as guilt, anger, and disgust, have also been considered to enhance the EPPM; for example, Basil et al. [32] integrated the complex emotional range of empathy and guilt to develop a consumer model of charity. However, in disaster and risk studies, fear-based emotion is long established and may be most relevant for further examination. Therefore, in this study, we focus on this construct and control for other possible emotional states by using a mental well-being variable, which will be discussed later.

The outcomes include message acceptance (success) and message rejection (failure), as further explained by the EPPM by the concepts of danger control responses and fear control responses, respectively (see also Table 1). Regarding danger control responses, prior surveys examined some dimensions related to attitude, intentions, and beliefs. For example, Weber et al. [26] defined some preparedness behaviours for future emergencies among university employees, including reading mass emails and emergency alerts by the university, listening to weather radio, accessing first aid kits, watching educational videos by the university regarding how to respond to an emergency such as an on-campus shooting, and studying educational posters regarding how to respond to weather or disease-related emergencies. Regarding fear control responses, Witte [28] defined three possible mechanisms: defensive avoidance, denial and reactance. For example, Ruiter et al. [31] measured the extent to which participants engaged in defensive avoidance via the question, "When I read the message about breast cancer, my first reaction was that I did not want to think about breast cancer" (1 – totally disagree to 9 – totally agree). Table 1 summarizes the central constructs used in the EPPM.

The EPPM employs the constructs of (i) fear, (ii) threat, as reflected by the underlying dimensions of severity and susceptibility, and (iii) efficacy, as reflected by the two underlying dimensions of self-efficacy and response efficacy, to predict the (iv) possible responses, which include danger control, fear control, and no response (see Fig. 1; Table 1). The model can therefore address the long-standing question regarding the success (i.e., danger control responses) or failure (i.e., fear control responses) of fear messages in public health campaigns.

However, the EPPM's internal validity is questionable, as Popova [27] observed. 1) Two pairs of core constructs (i.e., severity and susceptibility, self-efficacy and response efficacy) are assumed to follow an additive relationship, while empirical studies show mixed and inconclusive findings of either additive or multiplicative relationships [27]. Hence, it is challenging to measure the higher-level category of threat and efficacy based on these four underlying dimensions and the much-disputed relations (additive or multiplicative) among them. 2) The role of time is neglected or ignored when individuals spend time evaluating the threat and efficacy [27]. In a pandemic context, the emotional state of each individual is subject to changes in information flow from various sources and interactions with other individuals; therefore, the interaction between threat and efficacy may not be clear unless time effects are accounted for. 3) Preexisting emotions are treated as "individual differences" and disregarded in the model [27]. Former knowledge about the threat, however, should interact with the way people process the fear message, and more subtle layers of message processing should be explored and incorporated to improve the model's internal consistency, as Popova [27] suggested. The omission of other types of emotions may bias the model of fear.

3.2. Measurement of the core constructs

3.2.1. Perceived efficacy

Self-efficacy refers to the beliefs or perception of citizens regarding their ability to adopt the health message [28]. A common measurement can be the frequency of practising the message's health-promoting behaviours (e.g., how frequently the study participants practised precautionary behaviours, including wearing masks, hand hygiene, decreasing the use of public transportation, and avoiding crowded places or social events, measured with a 4-point Likert scale assigned to the frequency range: never, sometimes, often, or always at the beginning of the COVID-19 outbreak in South Korea [8]).

Response efficacy refers to the beliefs or perception of citizens regarding whether the health message is effective [28]. The question used to measure this concept can be phrased as follows: "To what extent do you think each precautionary behaviour can be effective in reducing the COVID-19 risk?" [8].

At a higher abstract level, these two concepts reflect individuals' cognition regarding the recommendations of the threat message or public health communication—i.e., **perceived efficacy** (see Table 1). Perceived efficacy can also be measured directly. For example, the efficacy of purchasing green electricity is measured via the item, "By switching to green electricity, I can contribute to mitigating climate change", and the efficacy of carbon tax support is measured with the statement, "Changing the behaviour of the society as a whole through measures such as taxing carbon emissions can reduce the risk that severe climate change will happen", both measured on a 5-point Likert scale (1 for "strongly disagree" and 5 for "strongly agree") [33].

3.2.2. Perceived threat

Susceptibility refers to the cognition of citizens regarding their probability of experiencing risks or threats [28]. This concept can be measured by asking a straightforward question about participants' beliefs regarding how vulnerable they are to being exposed to threats, such as, "How likely are you to become infected with COVID-19?" [8] or "How likely are the following scenarios (tornado, blizzard, school shooting, etc.) to occur in the next year?" [26].

Severity refers to the cognition of citizens regarding the severity or seriousness of the risks [28]. A possible measurement can be straightforward, as follows: "What do you think about the severity of COVID-19 if you are positive?" [8]. Alternatively, the measurement can be inferred by asking, "Which of these have you experienced as a result of weather-related/violence-related emergencies?" and presenting a list of possible items of scenarios. The responses are coded 1 (checked) or 0 (blank), and the cut-off score of the sum of all items is 6, reflecting a high impact [26].

At a higher abstract level, susceptibility and severity indicate individuals' belief or understanding of the risks or threats in their immediate surroundings—i.e., **perceived threat** (see Table 1). This perceived threat can be measured by factor reduction using two manifest variables: (1) threat probability (or susceptibility) (e.g., "How likely do you think it is that climate change will affect you?") and (2) threat severity (e.g., "How likely is it that you and your family will be affected by climate change?"), both on a 5-point scale (1 for "impossible" and 5 for "highly likely") [33].

3.3. Proposed modifications

The principal focus of the EPPM is to assess fear messages in changes and to predict such changes in individuals' behaviours, attitudes, and intentions as captured by the following outcomes: no responses, danger control responses or fear control responses. The model has been commonly applied in health studies of specific diseases or conditions (e.g., AIDS, influenza outbreak) [25,34,35]. While the main focus of this study is to examine the role of risk communication within an at-risk community, concepts from fear appeal theory may be useful and serve as a foundation to derive a quantitative model while addressing some weaknesses presented in the previous subsection reviewing the EPPM and fear theory.

Based on the EPPM, this study proposes alternative operationalized measures below for developing a risk communication model based on fear appeal theory.

For both the threat and efficacy measurements, the additive relationship of the four underlying measurements to efficiently predict a higher abstract level of both threat and efficacy is questionable [27]. The COVID-19 context is unique because most information tends to be uncorroborated in the age of fake news and global health emergencies [36], consensus among medical professionals worldwide has been delayed [37], and public health communication has been inconsistent (e.g., the mask wearing debate in early 2020) [38]. In particular, the manifesting variables of both threat (severity and susceptibility) and efficacy (self-efficacy and response efficacy) may be biased given citizens' self-rating of their perception based on the questionnaire designed by Lee & You [8] (see Table 1) because the public health messages at that time were subject to many changes based on ongoing scientific and medical development and exploration. Hence, we propose alternative measurements (see Table 2) to better estimate (i) the perception of risks through the act of seeking stakeholders within risk communication networks and (ii) the perception of general health-promoting recommendations through the dynamic choice of following the general recommendations during the emergency of COVID-19.

Within the setting of this study, the students gradually formed a risk communication network among themselves to discuss information regarding COVID-19 developments and to emotionally support each other. Messages related to health-promoting behaviours (i.e., social distancing, hand washing, mask wearing, and food/medicine stocking) were disseminated by both the government and the university. The data regarding how each respondent sought to consult with more (or fewer) colleagues and how the respondents actually adapted their behaviours in response to the message's recommendation depict their cognition of threat (i.e., COVID-19 risks) and efficacy (i.e., whether adopting the message would be effective in mitigating the risks). While these data may not entirely explain these two concepts according to the EPPM, they can serve as good predictors in this pandemic situation and facilitate an understanding of the fear-based model and relevant health-related behaviours, including risk communication inside a community.

For the proposed measurements to be meaningful, variables reflecting both threat (i.e., frequency of risk communication) and efficacy (i.e., health preventive measures) are assumed to have variances (i.e., changes in the number of (i) people specified in the risk-sharing network of respondents and (ii) health-promoting behaviours they adopt) at each phase of the study. Such variances are assumed to be explained by or attributed to each individual's cognition of the available information [16,39]. The respondents within the risk communication network are also assumed to interact within a defined network of risk discourse [40], and every individual is an equally important stakeholder in consulting about details regarding the pandemic (i.e., their continued act of seeking each other out is implied to be meaningful, and their discussion is pertinent to risk information, as clearly noted in the questionnaire).

The consideration of time effects in the EPPM [27] suggests the need to use longitudinal/panel data to better observe the dynamic process by which individuals process information. Additionally, the exclusion of the time dimension in risk communication can result in the omission of information on how citizens interact with each other and how they repeatedly manage or develop emotional coping mechanisms. Moreover, risk discourse within the context of a pandemic in a community is based on how stakeholders process the available information, which is highly subject to change over time. Therefore, excluding time effects in studying risk communication and fear may result in the omission of many important pieces of information.

Popova [27] also suggested that preexisting emotions impact the processing of fear messages, and some studies have found supporting empirical evidence of such an impact [41–43]. To address the preexisting emotions that were lacking in prior fear studies, we consider one parameter reflecting mental status or health to control for such effects of the complex spectrum of different emotions. In the literature, many studies employ the 12-item General Health Questionnaire (GHQ) as a screening tool for self-assessment among different samples from clinical settings to the general population. Originally, the GHQ by Goldberg [44] had 60 items, but currently,

Table 2
Alternative operationalized measurements of variables based on fear appeal theory.

Constructs	Operationalized measurements	Corresponding variables
Fear	Subjective rating of *nervousness* or *anxiety* towards disasters in general in Japan. Respondents are asked, "As a foreigner living in Japan, how nervous or anxious do you feel about disasters (e.g., earthquakes, floods, health emergencies)?" Score: 1 – no problem at all; 5 – very nervous or anxious.	Fear of (general) disasters in Japan
Threat as manifested by (i) **severity** and (ii) **susceptibility**	Rather than designing ad hoc survey items for two underlying dimensions as a common practice, we assume that seeking community-led risk deliberation implies cognition regarding the threat (i.e., the COVID-19 pandemic). Respondents are asked, "Among the community, with whom did you have a discussion/communication about recent coronavirus issues, both face to face and in an online platform?" Measurement is based on the ratio of the number of people with whom each individual communicates to the maximum of people possible within the boundary of the network.	Frequency of communication within the same network of students
Efficacy as manifested by (i) **self-efficacy** and (ii) **response efficacy**	During this unprecedented pandemic, no concrete health-promoting behaviours are conclusive because discussions are shifting towards the philosophy of freedom; therefore, designing survey items to predict respondents' cognition is challenging. Instead, the number of health preventive measures adopted can be a good indicator of how much respondents (i) think they can adopt such behaviours (self-efficacy) and (ii) believe in the effectiveness of such behaviours (response efficacy). Respondents are asked to choose all that apply among the four measures: (1) social distancing, (2) hand washing, (3) mask wearing, and (4) stocking up on groceries, medicine, and resources.	Health preventive measures

there are multiple versions. In particular, the 12-item version is the most widely used version, with many surveys confirming its reliability and validity in different domains (i.e., different countries and/or samples of different socioeconomic backgrounds) [45,46]. Drawing upon relevant surveys, we conducted a factor analysis to examine the factor structure in the study sample as a first step to derive the parameters of mental well-being for the subsequent analysis of the fear model. Section 4.2 discusses the measurement of mental health parameters in detail.

4. Research methodology

4.1. Research question and model specification

This paper aims to address the following question: How do risk communication and other health-related behaviours affect the fear of disasters within a risk-sharing network of foreign students during the COVID-19 pandemic? In other words, we studied the causal mechanisms of how the fear of disasters, especially in a country stricken by multiple disasters amid a pandemic, such as Japan,[1] can be explained by the independent variables of (i) mental well-being, (ii) preventive measures against COVID-19, and (iii) the frequency of both face-to-face and social media exchanges of risk information and theoretically important variables in the study of risk perception, (iv) country and (v) gender.

Therefore, the proposed model of disaster perception and its explanatory variables is expressed as follows. The dependent variable "*fear of disasters*" is fear or anxiety in general towards any disaster[2] in Japan (e.g., tsunamis, earthquakes, floods), which is the main variable of interest in capturing and explaining the interplay of information exchange and other independent variables within a closed network for health risk communication. The independent variables are as follows: (i) "*frequency of communication",* or the ratio of how many respondents interacted in the total of 37 students (i.e., interaction via both face-to-face meeting and the online social platform among the total of 37 possible students within the specified boundary of the network); (ii) "*health preventive measures*", which refer to the number of health preventive measures the respondents adopted in response to the pandemic; (iii) the interaction term to capture the combined effect of communication and health measures adopted; (iv) "*mental well-being*" at each period of time; and the control variables (v) country and (vi) gender.

4.2. Data collection and measurements

The research participants were 37 first-year students in the Master of Public Administration (MPA) programme in a Japanese graduate school from 14 different countries and backgrounds. They were all foreign (i.e., non-Japanese) students with limited Japanese language skills and less than seven months of residency in Japan; this characteristic may place them in a group considered vulnerable [10] to disaster risk. This group of students and their families lived in a close and small community in a remote rural area,

[1] For example, even in the middle of the COVID-19 pandemic in Japan, heavy rain caused deadly flooding in the prefectures of Kumamoto and Kagoshima in July 2020, and a strong earthquake hit the Tohoku area, including the prefectures of Fukushima and Miyagi, in February 2021.

[2] A disaster or natural hazard, in our assumption, is related to the pandemic [63]. Although the International Federation of Red Cross and Red Crescent Societies classified pandemics as a natural hazard [63], we assume that the general public perceives the word "disaster" in a general sense of threatening their life, and people rarely distinguish the nuances of words such as disaster or pandemic. However, this perception of whether the pandemic is viewed as a disaster, irrespective of the official definition, could be questionable.

mainly within university dormitories.

The students were given a self-report survey[3] at three consecutive time points that spanned from March 18 to 27, 2020; (i) March 18 to 21 (34/37 responses), (ii) March 22 to 24 (33/37 responses), and (iii) March 25 to 27 (31/37 responses). Within these intervals, international and local newspapers and social media provided a large amount of new information relating to the pandemic and different countries' responses. It could be asserted that all knowledge up to that point was chaotic; hence, time effects were included to observe the students' changing perceptions and confusion, especially when they could not fully grasp the local or domestic news sources and instead relied heavily on international news as well as exchanges within their own local community (i.e., within a closed network). This approach could thus be expected to yield useful information about dynamic changes in their behaviours.

The self-report survey sought to determine (i) the frequency of health risk exchanges through both online platforms and offline meetings with students in the same programme within a delineated specification of a network, i.e., the same set of university students; (ii) their adoption of health preventive measures recommended by the government (i.e., physical distancing, hand washing, mask wearing, and stocking up on food and water), (iii) their own rating of their mental well-being at each period using the 12-item GHQ (GHQ-12) [44], and (iv) their general disaster fear as a self-evaluation of their level of anxiety about general and common disasters in Japan (see Table 2 for a description of the measurements of these variables).

Considering that psychological or mental health variables cannot be directly measured and, as mentioned in subsection 3.2, the GHQ-12 has been found to effectively reflect this concept in various samples [44,45,47], we conducted a factor analysis of 12 items of the GHQ based on our proposed structure and the previously confirmed structure in the extensive literature. However, previous studies on the GHQ-12 provided inconclusive findings about the factor structure, and Liang et al. [45] found that the unidimensional, two-dimensional, and three-dimensional structures all fit the population of young Chinese civil servants who are at risk for mental disorders. Therefore, the 12-item questionnaire has the potential to reflect the mental well-being variable in different at-risk population settings from unidimensional to three-dimensional structure models. The sample in this study comprises vulnerable respondents; during the unprecedented COVID-19 pandemic, this sample can be placed in a group with a high risk of mental health issues. The GHQ-12 questionnaire is therefore suitable for screening the general psychology of the respondents.

Many earlier studies determining the factor structure of the GHQ-12 proposed different groupings in different sets of samples, e.g., based on some assumption of wording effects to determine the unidimensional structure [48]. This suggests that the GHQ-12 must be adapted for use in our sample. We propose a two-dimensional model based on the dichotomy of positive and negative wording accompanied by reverse coding to increase the respondents' concentration in completing the survey (see Table 3).

Table 4 summarizes the descriptive statistics of the variables for the fear of disasters model. The overall mean, standard deviation, and range of minimum to maximum values of the variables show that there are no anomalous values among the data. Table 5 shows that the correlation among variables is low enough that there is no multicollinearity problem in our model. Notably, a strong correlation was found between the interaction term comprising risk communication and preventive measures and the frequency of risk communication, but this correlation was attributed to their inherent relationship (i.e., the interaction term containing the other variable).

On average, each student tried to contact two to three colleagues (i.e., the mean of .065 times 37 students), and the total maximum possible contact was 37 students. Each student adopted nearly three out of four health-promoting behaviours, indicating a general willingness of this sample to adopt such behaviours.

Of the students from 14 different countries, most were from Asian countries (32 students, or 86%; see Table 4), four were from Europe, and one was from Africa. Even within Asian countries, the backgrounds of the students were highly diverse, spanning Southeast Asia and South Asia to Central Asia. Our assumption was that the classification of Asian and non-Asian populations could be useful in yielding more explanatory power for the model rather than a more complex category of races. On the other hand, the ratio of female to male students was almost evenly distributed (18:19, or 48%; see Table 4); this balance may be useful as the sample had a representative number of men and women. Therefore, the inclusion of gender-specific and racial variables can improve the predictive power of the model, as Flynn et al. [49] and Ho et al. [50] concluded.

4.3. Methods

The dataset in this study is a fixed panel ($n = 37$, $T = 3$) with slightly unbalanced data (due to some missing responses). Despite the unbalanced data, the overall panel data can still be considered strongly balanced (T is close to 3 for each variable; see Table 4) with only a few missing values: there are three time points with 34, 33, and 31 responses received, and in total, $N = 94$ observations are used in the regression model. The panel data structure deals with the unobserved heterogeneity that can result in both biased and inefficient estimated coefficients [51]. Fixed-effects and random-effects models have been widely employed to examine unobservable individual effects in panel data. The model in question includes time-invariant individual-specific variables (i.e., country-specific and/or gender effects) as these variables show meaningful interpretations of risk perception in natural disaster studies, as noted by Flynn et al. [49]; Bontempo et al. [52]; West & Orr [53]; and Ho et al. [50]. The inclusion of these two crucial variables rules out the competing model

[3] The survey was conducted in English, and the students admitted to this graduate programme were expected to have a good command of English for admission with the following minimum requirements: TOEFL paper-based exam, 550; internet-based exam, 80; IELTS, 6.5; TOEIC, 800. Please find the self-report form in Table 7.

Table 3
Two-dimensional model based on the dichotomy of positive and negative wording.

Latent variable	Manifest variable (GHQ-12)	Note
Positive wording	Able to lead a happy life	GHQ-6
	Able to face your own difficulties	GHQ-7
	Able to concentrate on doing anything	GHQ-10
	Feeling that you are a useful person	GHQ-11
	Feeling happy in general	GHQ-12
Negative wording	Feeling that you have not made good use of time	GHQ-1*
	Feeling that you were not decisive	GHQ-2*
	Feeling that you suffered from pressure	GHQ-3*
	Feeling that you could not overcome your own difficulties	GHQ-4*
	Feeling unhappy or distressed	GHQ-5*
	Sleepless because of worrying about something	GHQ-8*
	Having lost self-confidence	GHQ-9*

Note: (*) Reverse coded item to (i) increase the respondents' concentration and, more importantly, (ii) adopt a dichotomous scheme to adapt the GHQ-12 questionnaire for a new sample of the population.

Table 4
Descriptive statistics of the variables for the fear of disasters model.

Variable		Mean	Std. Dev.	Min	Max	Observations
Fear of disasters	overall	2.755	1.244	1	5	N = 98
	between		1.085	1	5	n = 36
	within		.614	.088	4.755	T = 2.722
Frequency of communication	overall	.065	.063	0	.324	N = 98
	between		.055	0	.18	n = 36
	within		.032	-.025	.219	T = 2.722
Adoption of preventive measures	overall	2.776	.969	0	4	N = 98
	between		.809	0	4	n = 36
	within		.547	.776	4.109	T = 2.722
Risk communication × Preventive measures	overall	.178	.186	0	.865	N = 98
	between		.153	0	.613	n = 36
	within		.104	-.2	.557	T = 2.722
Mental well-being (positive wording)	overall	3.618	.714	2	5	N = 96
	between		.605	2.266	5	n = 35
	within		.356	2.485	4.685	T = 2.742
Mental well-being (negative wording)	overall	3.635	.761	1.666	5	N = 96
	between		.661	2.25		n = 36
	within		.420	2.079	4.968	T = 2.666
Asian	overall	.864	.343	0	1	N = 111
	between		.346	0	1	n = 37
	within		0	.864	.864	T = 3
Female	overall	.48	.502	0	1	N = 111
	between		.506	0	1	n = 37
	within		0	.48	.48	T = 3

(fixed-effects models) for addressing the panel data structure because of its limitations of the perfect collinearity of country/gender effects and the time-invariant error term [54]. Lee [55] identified the greatest flaw in utilizing the fixed-effects model: perfect collinearity of theoretically important dummy variables and time-unchanging variables. Hence, he argued that employing random effects is more useful for estimation.[4]

5. Results

Table 6 shows the estimated results for the effects of risk communication and health-related behaviours on the fear of disasters. Overall, the Wald test shows a good fit of the model with the explanatory variables (p value of .019). Hence, the random-effects model is reasonable and efficient for the estimation.

The coefficient of "frequency of risk communication" shows that with a one percentage point increase in the number of people exchanging risk information, the general fear of disasters is expected to increase by 11.757%, ceteris paribus ($p < .05$). This causal mechanism may be due to the "pressure cooker" effect [56] in which risk communication within the closed community increases the perceived anxiety level. In the same relationship, for a one-unit increase in the number of health preventive measures adopted, the fear

[4] The random effects model's assumption that no correlation exists between unobserved, time-constant factors and the explanatory variables can be problematic. Therefore, we performed the Hausman test for both FE and RE while excluding two theoretically important variables: gender and country. The result shows that the random effects model is still valid for estimation. The benefit of including those two crucial dummy variables for estimation further implies that the random effects model is preferred.

Table 5
Pairwise correlations of the variables.

Variable	Fear of Disasters	Frequency of risk communication	Adoption of preventive measures	Risk communication × Preventive measures	Mental well-being (positive wording)	Mental well-being (negative wording)	Asian	Female
Fear of disasters	1.000							
Frequency of risk communication	0.029	1.000						
Adoption of preventive measures	0.245**	−0.054	1.000					
Risk communication × Preventive measures	0.022	0.872***	0.289***	1.000				
Mental well-being (positive wording)	−0.154	0.027	−0.255**	−0.016	1.000			
Mental well-being (negative wording)	−0.311***	−0.072	−0.194*	−0.092	0.483***	1.000		
Asian	−0.151	0.011	0.147	0.112	0.004	−0.113	1.000	
Female	0.004	0.086	0.155	0.160	−0.088	−0.136	0.272***	1.000

***p < .01, **p < .05, *p < .10.

Table 6
Estimated results for the effects of risk communication and health-related behaviours on the fear of disasters.

Mixed-effects ML regression							
Fear of disasters	Coef.	St. Err.	t value	p value	[95% Conf	Interval]	Sig.
t1	.169	.202	0.84	.401	-.226	.565	
t2	.191	.194	0.99	.325	-.189	.57	
Frequency of risk communication	11.757	4.873	2.41	.016	2.207	21.307	**
Adoption of preventive measures	.422	.18	2.34	.019	.068	.775	**
Risk communication × Preventive measures	−3.247	1.65	−1.97	.049	−6.48	-.014	**
Mental well-being (positive wording)	.108	.187	0.58	.564	-.259	.475	
Mental well-being (negative wording)	-.522	.167	−3.12	.002	-.849	-.195	***
Asian	-.954	.531	−1.80	.072	−1.995	.087	*
Female	.044	.349	0.13	.899	-.639	.727	
Constant	3.595	1.047	3.43	.001	1.543	5.648	***
Mean dependent var	2.787	SD dependent var	1.252				
Number of obs	94.000	Chi-square	19.902				
Prob > chi 2	0.019	Akaike crit. (AIC)	282.140				

***p < .01, **p < .05, *p < .10.

of disasters is expected to increase by .422, ceteris paribus ($p < .05$). Interestingly, the joint effect of risk communication and precautionary health behaviours shows that for every one percentage point increase in this effect, the fear of disasters actually decreases by 3.247%, ceteris paribus ($p < .05$). In other words, the more risk information exchange and the more health preventive measures adopted, the more negative feelings non-Japanese students experience related to potential or observed disasters in Japan. Taking into account the combined effect of risk information sharing and the preventive measures adopted, we find that negative feelings towards disasters can be alleviated.

Factor 1, "positive wording" for mental well-being, showed a nonsignificant effect in the model (p value of .564). This result may imply that in this sample, "positive wording" has no clear or weak effect on the "fear of disasters" variable. However, for a one-unit increase in Factor 2, "negative wording" for mental well-being, the "fear of disasters" variable is expected to decrease by 0.522, ceteris paribus ($p < .01$). Notably, all the points for these items in Factor 2 are reverse coded for calculation (see Table 3), implying that "negative wording" in fact strongly and positively correlates with the dependent variable itself. This finding is consistent with our expectation that an increase in students' negative attitude at the time indicates a greater fear of disasters.

The racial variable suggests that being Asian implies having a "fear of disaster" level that is 0.954 less (nearly a one-point difference on a Likert scale) than the level for non-Asian students ($p < .10$). This finding may have arisen because Asian students may be more aware of Japanese culture and able to more easily obtain relevant information. They may therefore have better psychological preparation than non-Asian groups. Additionally, the cultural exchange and active cooperation between Japan and other Asian countries may inform Asian citizens, particularly Asian students, of many general aspects and images of Japan. For example, citizens from several ASEAN countries tend to have an increasingly favourable perception of Japan over time [57], which may explain the difference between the two groups in their fear of disasters.

The gender difference in this sample does not have a clear effect on the fear of disasters, with a large p value (0.899). In fact,

Table 7
Copy of the distributed questionnaire.

1. Among first-year PMPP students, with whom did you have a face-to-face discussion/communication about recent coronavirus issues over the last three days (between March 19 and March 21/March 22 and March 24/March 25 and March 27)?
   Select as many as possible out of 37 students (Please check using V)
   (*List the 37 students' names*)
2. Among first-year PMPP students, with whom did you have an online discussion/communication about recent coronavirus issues over the last three days (between March 19 and March 21/March 22 and March 24/March 25 and March 27)?
   Select as many as possible out of 37 students (Please check using V)
   (*List the 37 students' names*)
3. To protect against coronavirus, many prevention measures are recommended. Among those listed below, which one(s) have you followed over the last three days (between March 19 and March 21/March 22 and March 24/March 25 and March 27)?
   Select as many as possible out of 4 measures (Please check using V).

Social distancing
Hand-washing
Mask-wearing
Stocking up on groceries, medicine, and resources

4. Could you rate your current conditions over the last three days (between March 19 and March 21/March 22 and March 24/March 25 and March 27)?
   *Evaluate the following criteria and select the appropriate rating, with 5 being the highest score (*i.e., *strongly agree) and 1 being the lowest score (*i.e., *strongly disagree).*

Feeling that you had not made good use of time.
Feeling that you were not decisive.
Feeling that you suffered from pressure.
Feeling that you could not overcome your own difficulties.
Feeling unhappy or distressed.
Able to lead a happy life.
Able to face your own difficulties.
Sleepless because of worrying about something.
Having lost self-confidence.
Able to concentrate on doing anything.
Feeling that you were a useful person.
Feeling happy in general.

5. As a foreigner living in Japan, how nervous or anxious did you feel about disasters (e.g., earthquakes, floods, health emergencies) over the last three days (between March 19 and March 21/March 22 and March 24/March 25 and March 27)?
   *Evaluate by selecting the appropriate rating, with 5 being the highest score (*i.e., *very nervous or anxious) and 1 being the lowest score (*i.e., *no problem at all).*

Your answer (rating)

Gustafson [58] suggested that psychometric studies might not clearly show gender differences in risk perception. Some disaster studies, such as Steinglass & Gerrity [59]; Neumayer & Plumper [60]; and Ho et al. [50]; conducted within a homogeneous population (i.e., a sample with the same cultural background) found gender differences to be a good predictor of hazard perception. In contrast, the sample in this study was drawn from a group of international students of different backgrounds and thus may not clearly show a meaningful interpretation of gender differences. In other words, the variables related to individual differences in this sample may be better reflected in terms of the country of origin rather than gender.

6. Discussion

This paper suggests four implications for foreign students staying in Japan who face the unprecedented situation of COVID-19. First, simply adopting health preventive measures as recommended can indicate an increasing general fear of disasters. If the community of non-Japanese students adopts the recommended voluntary measures, their adoption may be due to their increasing anxiety level rather than their own willingness to do so. Each foreign student was increasingly anxious about disasters in general as international news sometimes made conflicting statements about the current pandemic situation, e.g., the debate on whether wearing masks is effective or recommended physical distancing. In such instances, foreigners in Japan might have no choice but to adopt more of these measures as their fear of disasters increases.

Second, risk communication at face value also indicates a worsening of the fear of disasters. Community-led risk deliberation is an active way for individual foreigners in Japan to seek more news or information regarding the changing pandemic situation, and over time, they become increasingly concerned as they gain more information. This result supports the finding from a rational model questioning the benefits of risk communication, as Alaszewski [61] suggested. Nonetheless, we should be cautious in interpreting this effect as the next finding suggests a different conclusion.

Third, as mentioned above, exchanges among individuals about the pandemic or their health-promoting behaviours individually reinforce foreign students' fear of disasters in Japan. However, the empirical evidence in this study also confirms the interaction effect between risk-sharing and health preventive measures, which may support the possibility of a reciprocal relationship between threat and efficacy under the assumption of the simultaneous appraisal of threat messages rather than sequential assumptions, as suggested by Popova [27]. Retrospectively Witte [28] found that threat and efficacy were processed in a sequential manner. However, Lewis et al. [62] found that response efficacy (i.e., manifesting variable of efficacy, showing the cognition of individuals regarding the effectiveness of the recommendation from the fear message) has a mediating effect on fear when the threat level is increasing; in other words, the fear control response mechanism of the model and the sequential appraisal assumption (i.e., citizens process threat messages first and then the efficacy of measures, or the reverse) are called into question. Our finding, to a certain extent, confirms the

evidence of the interactive effect of citizens' risk deliberation and public health communication on manners and preventive practices adopted during health crises with joint moderation of anxiety levels (i.e., fear per se).

7. Conclusions

Based on our study results, our major findings are as follows: (i) adopting health preventive measures as recommended by the government and (ii) risk communication may individually be an indication of fear regarding disaster perception for foreign students in Japan; (iii) community-led risk discourse on good practices to prevent the transmission of COVID-19 and pandemic information combined with the adoption of preventive health behaviours can have a moderating effect on the anxiety or stress level of each individual; and finally, (iv) country-specific determinants are meaningful in natural disaster research, while gender-specific differences in this pandemic setting and quantitative methods may not exhibit significantly meaningful effects. In particular, the evidence of a significantly meaningful interaction of community-led risk discourse and government-recommended public health behaviours may contribute to fear theory in general and to the EPPM in particular regarding the possible interaction effect of threat and efficacy on fear-based emotion. These evidence-based findings emphasize the role of risk communication during a highly contagious disease outbreak, leading to greater acceptance of relevant policies against infectious disease and greater efficiency of these policies within communities, thereby producing the intended results.

Despite the methodology chosen for data analysis, there are some limitations to the current study design. First, this study utilized the 12-item GHQ to predict the mental subjective health of the respondents with a two-dimensional structure accompanying the reverse coding scheme. However, this design may suffer from wording effects or negative phrasing [48]; thus, there is potential response bias in this factor analysis of a two-dimensional structure. Future studies with both exploratory and confirmatory factor analyses may involve adapting and identifying a better version of the GHQ-12 by controlling for wording effects and thereby determining a better and more detailed factor structure for the international student population.

Second, while the random-effects model assumes that unobserved individual effects do not correlate with the explanatory variables, the random-effects model in this paper may violate this assumption, and unobservable additional socioeconomic and cultural factors may exist. For example, in our model, we assumed that the risk communication variable (or "threat") is reflected in the frequency of exchange of individuals within a network. However, threat may also be reflected in the frequency of intangible social support with specific students. This potential bias embedded within the unobservable heterogeneity captured in the error term can render the model both biased and inefficient. Future studies with a larger sample size and different samples can address this source of bias and inefficiency.

Third, country-specific factors can be a good predictor in studies of natural disasters, while gender-specific differences may call for qualitative rather than quantitative approaches, as Gustafson [58] suggested. The background of each respondent can shape his or her ways of thinking and resulting behaviours from culture to culture. This evidence warrants more in-depth studies on socioeconomic determinants and risk perception in the international student population. Gender differences may involve a more theory-based approach prior to quantitative examination of causal inferences in natural disaster research.

Fourth, the data sample in this study was collected from a university with a group of students in one graduate programme. Although the international background of students from several countries can be representative of foreign students in Japan, caution is advised when generalizing our conclusions. Future research in different domains may address this generalization issue.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] J.A. Lewnard, V.X. Liu, M.L. Jackson, M.A. Schmidt, B.L. Jewell, J.P. Flores, C. Jentz, G.R. Northrup, A. Mahmud, A.L. Reingold, M. Petersen, N.P. Jewell, S. Young, J. Bellows, Incidence, clinical outcomes, and transmission dynamics of severe coronavirus disease 2019 in California and Washington: prospective cohort study, BMJ 369 (2020) m1923.
[2] WHO, COVID-19 Weekly Epidemiological Update, 2020. November, 1;4, https://www.who.int/docs/default-source/coronaviruse/situation-reports/20201012-weekly-epi-update-9.pdf.
[3] G. Trevors, M.C. Duffy, Correcting COVID-19 misconceptions requires caution, Educ. Res. 49 (7) (2020) 538–542.
[4] Q. Chen, C. Min, W. Zhang, G. Wang, X. Ma, R. Evans, Unpacking the black box: how to promote citizen engagement through government social media during the COVID-19 crisis, Comput. Hum. Behav. 110 (2020) 106380.
[5] C. Clark, A. Davila, M. Regis, S. Kraus, Predictors of COVID-19 voluntary compliance behaviors: an international investigation, Glob. Transit. 2 (2020) 76–82.
[6] R. Shaw, Y. Kim, J. Hua, Governance, technology and citizen behavior in pandemic: lessons from COVID-19 in East Asia, Prog. Disast. Sci. 6 (2020) 100090.
[7] B. Reynolds, M.W. Seeger, Crisis and emergency risk communication as an integrative model, J. Health Commun. 10 (1) (2005) 43–55.
[8] M. Lee, M. You, Psychological and behavioral responses in South Korea during the early stages of coronavirus disease 2019 (COVID-19), Int. J. Environ. Res. Publ. Health 17 (9) (2020) 2977.
[9] K. Witte, Generating effective risk messages: how scary should your risk communication be? Ann. Int. Commun. Assoc. 18 (1) (1995) 229–254.
[10] O.A. Gómez, Lessons from international students' reaction to the 2011 Great East Japan Earthquake: the case of the school of engineering at Tohoku University, Int. J. Disast. Risk Sci. 4 (3) (2013) 137–149.
[11] T. Xiang, B.J. Gerber, F. Zhang, Language access in emergency and disaster preparedness: an assessment of local government "whole community" efforts in the United States, Int. J. Disaster Risk Reduc. 55 (March) (2021), 102072.
[12] R.L. Heath, Corporate environmental risk communication: cases and practices along the Texas Gulf Coast, Ann. Int. Commun. Assoc. 18 (1) (1995) 255–277.
[13] National Research Council, Improving Risk Communication, National Academy Press, Washington, DC, 1989.
[14] B. Reynolds, S. Quinn Crouse, Effective communication during an influenza pandemic: the value of using a crisis and emergency risk communication framework, Health Promot. Pract. 9 (4 Suppl) (2008) 13–17.

[15] A. Husnayain, A. Fuad, E.C.-Y. Su, Applications of Google Search Trends for risk communication in infectious disease management: a case study of COVID-19 outbreak in Taiwan, Int. J. Infect. Dis. 95 (2020) 221–223.
[16] S. Lim, H. Nakazato, The emergence of risk communication networks and the development of citizen health-related behaviors during the COVID-19 pandemic: social selection and contagion processes, Int. J. Environ. Res. Publ. Health 17 (11) (2020) 1–12.
[17] L. Zhang, H. Li, K. Chen, Effective risk communication for public health emergency: reflection on the COVID-19 (2019-nCoV) outbreak in Wuhan, China, Healthcare 8 (1) (2020) 64.
[18] S. Roeser, Risk communication, public engagement, and climate change: a role for emotions, Risk Anal. 32 (6) (2012) 1033–1040.
[19] S. Lim, F.S. Berry, K.-H. Lee, Stakeholders in the same bed with different dreams: semantic network analysis of issue interpretation in risk policy related to mad cow disease, J. Publ. Adm. Res. Theor. 26 (1) (2016) 79–93.
[20] K. Witte, Putting the fear back into fear appeals: the extended parallel process model, Commun. Monogr. 59 (4) (1992) 329–349.
[21] C.I. Hovland, I.L. Janis, H.H. Kelley, Communication and Persuasion, Yale University Press, New Haven, CT, 1953.
[22] H. Leventhal, Findings and theory in the study of fear communications, Adv. Exp. Soc. Psychol. 5 (1970) 119–186.
[23] R.W. Rogers, A protection motivation theory of fear appeals and attitude change, J. Psychol. 91 (1) (1975) 93–114.
[24] R.W. Rogers, Cognitive and psychological processes in fear appeals and attitude change: a revised theory of protection motivation, in: J.C. Petty, R E (Eds.), Social Psychophysiology: A Sourcebook, Guilford Press, New York, NY, 1983, pp. 153–176.
[25] D.J. Barnett, R.D. Balicer, C.B. Thompson, J.D. Storey, S.B. Omer, N.L. Semon, S. Bayer, L.V. Cheek, K.W. Gateley, K.M. Lanza, Assessment of local public health workers' willingness to respond to pandemic influenza through application of the extended parallel process model, PLoS One 4 (7) (2009) e6365.
[26] M.C. Weber, S.E. Schulenberg, E.C. Lair, University employees' preparedness for natural hazards and incidents of mass violence: an application of the extended parallel process model, Int. J. Disaster Risk Reduc. 31 (April) (2018) 1082–1091.
[27] L. Popova, The extended parallel process model: illuminating the gaps in research, Health Educ. Behav. 39 (4) (2012) 455–473.
[28] K. Witte, Fear as motivator, fear as inhibitor, in: P.A. Andersen, L.K. Guerrero (Eds.), Handbook of Communication and Emotion: Research, Theory, Applications, and Contexts, Academic Press, San Diego, CA, 1998, pp. 423–450.
[29] S. McMahan, K. Witte, J. Meyer, The perception of risk messages regarding electromagnetic fields: extending the extended parallel process model to an unknown risk, Health Commun. 10 (3) (1998) 247–259.
[30] J.R. Ordoñana, F. Gonzalez-Javier, L. Espin-Lopez, J. Gomez-Amor, Self-report and psychophysiological responses to fear appeals, Hum. Commun. Res. 35 (2) (2009) 195–220.
[31] R.A.C. Ruiter, B. Verplanken, D. De Cremer, G. Kok, Danger and fear control in response to fear appeals: the role of need for cognition, Basic Appl. Soc. Psychol. 26 (1) (2004) 13–24.
[32] D.Z. Basil, N.M. Ridgway, M.D. Basil, Guilt and giving: a process model of empathy and efficacy, Psychol. Market. 25 (1) (2008) 1–23.
[33] P. Hartmann, V. Apaolaza, C. D'Souza, J.M. Barrutia, C. Echebarria, Environmental threat appeals in green advertising, Int. J. Advert. 33 (4) (2014) 741–765.
[34] D.J. Barnett, C.B. Thompson, N.L. Semon, N.A. Errett, K.L. Harrison, M.K. Anderson, J.L. Ferrell, J.M. Freiheit, R. Hudson, M. McKee, EPPM and willingness to respond: the role of risk and efficacy communication in strengthening public health emergency response systems, Health Commun. 29 (6) (2014) 598–609.
[35] M.K. Casey, L. Timmermann, M. Allen, S. Krahn, K.L. Turkiewicz, Response and self-efficacy of condom use: a meta-analysis of this important element of AIDS education and prevention, South. Commun. J. 74 (1) (2009) 57–78.
[36] S.B. Naeem, R. Bhatti, The Covid-19 'infodemic': a new front for information professionals, Health Inf. Libr. J. 37 (3) (2020) 233–239.
[37] WHO. (n.d.). Archived: WHO Timeline - COVID-19. Retrieved February 4, 2021, from https://www.who.int/news/item/27-04-2020-who-timeline—covid-19.
[38] G.P. Martin, E. Hanna, M. McCartney, R. Dingwall, Science, society, and policy in the face of uncertainty: reflections on the debate around face coverings for the public during COVID-19, Crit. Publ. Health 30 (5) (2020) 501–508.
[39] P.-W. Wang, Y.-L. Chen, Y.-P. Chang, C.-F. Wu, W.-H. Lu, C.-F. Yen, Sources of COVID-19-related information in people with various levels of risk perception and preventive behaviors in Taiwan: a latent profile analysis, Int. J. Environ. Res. Publ. Health 18 (4) (2021) 2091.
[40] D. Knoke, S. Yang, Social Network Analysis, second ed., Sage, Thousand Oaks, CA, 2008.
[41] T.D. Gore, C.C. Bracken, Testing the theoretical design of a health risk message: reexamining the major tenets of the extended parallel process model, Health Educ. Behav. 32 (1) (2005) 27–41.
[42] D.L. McKay, J.M. Berkowitz, J.B. Blumberg, J.P. Goldberg, Communicating cardiovascular disease risk due to elevated homocysteine levels: using the EPPM to develop print materials, Health Educ. Behav. 31 (3) (2004) 355–371.
[43] N. Muthusamy, T.R. Levine, R. Weber, Scaring the already scared: some problems with HIV/AIDS fear appeals in Namibia, J. Commun. 59 (2) (2009) 317–344.
[44] D. Goldberg, The Detection of Psychiatric Illness by Questionnaire, Oxford University Press, London, UK, 1972.
[45] Y. Liang, L. Wang, X. Yin, The factor structure of the 12-item general health questionnaire (GHQ-12) in young Chinese civil servants, Health Qual. Life Outcome 14 (1) (2016) 1–9.
[46] N. Schmitz, J. Kruse, W. Tress, Psychometric properties of the General Health Questionnaire (GHQ-12) in a German primary care sample, Acta Psychiatr. Scand. 100 (6) (1999) 462–468.
[47] H. Nakazato, S. Lim, Interplay between social support tie formations and subjective mental health conditions in a community currency system in Japanese disaster-affected communities: the ambivalent effects of social capital, Int. J. Disaster Risk Reduc. 51 (December) (2020) 101809.
[48] M. Hankins, The factor structure of the twelve item General Health Questionnaire (GHQ-12): the result of negative phrasing? Clin. Pract. Epidemiol. Ment. Health 4 (2008) 10.
[49] J. Flynn, P. Slovic, C.K. Mertz, Gender, race, and perception of environmental health risks, Risk Anal. 14 (6) (1994) 1101–1108.
[50] M.C. Ho, D. Shaw, S. Lin, Y.C. Chiu, How do disaster characteristics influence risk perception? Risk Anal. 28 (3) (2008) 635–643.
[51] W.H. Greene, Econometric Analysis, second ed., Prentice-Hall, Englewood Cliffs, NJ, 1993.
[52] R.N. Bontempo, W.P. Bottom, E.U. Weber, Cross-cultural differences in risk perception: a model-based approach, Risk Anal. 17 (4) (1997) 479–488.
[53] D.M. West, M. Orr, Race, gender, and communications in natural disasters, Pol. Stud. J. 35 (4) (2007) 569–586.
[54] G.S. Maddala, Introduction to Econometrics, second ed., Macmillan, New York, NY, 1992.
[55] C.S. Lee, Income inequality, democracy, and public sector size, Am. Socio. Rev. 70 (1) (2005) 158–181.
[56] S.E. Hobfoll, P. London, The relationship of self-concept and social support to emotional distress among women during war, J. Soc. Clin. Psychol. 4 (2) (1986) 189–203.
[57] MOFA. (n.d.). Opinion Poll on Japan in ten ASEAN Countries. Retrieved February 5, 2021, from https://www.mofa.go.jp/press/release/press4e_001780.html.
[58] P.E. Gustafson, Gender differences in risk perception: theoretical and methodological perspectives, Risk Anal. 18 (6) (1998) 805–811.
[59] P. Steinglass, E. Gerrity, Natural disasters and post-traumatic stress disorder short-term versus long-term recovery in two disaster-affected communities, J. Appl. Soc. Psychol. 20 (21) (1990) 1746–1765.
[60] E. Neumayer, T. Plümper, The gendered nature of natural disasters: the impact of catastrophic events on the gender gap in life expectancy, 1981-2002, Ann. Assoc. Am. Geogr. 97 (3) (2007) 551–566.
[61] A. Alaszewski, Risk communication: identifying the importance of social context, Health Risk Soc. 7 (2) (2005) 101–105.
[62] I.M. Lewis, B. Watson, K.M. White, Response efficacy: the key to minimizing rejection and maximizing acceptance of emotion-based anti-speeding messages, Accid. Anal. Prev. 42 (2) (2010) 459–467.
[63] H. Seddighi, COVID-19 as a natural disaster: focusing on exposure and vulnerability for response, Disaster Med. Public Health Prep. 14 (4) (2020) e42–e43.